

IDAHO

FISH & GAME DEPARTMENT

John R. Woodworth, Director

FEDERAL AID IN FISH AND WILDLIFE RESTORATION

JOB COMPLETION REPORT

Project F-53-R-6



LAKE AND RESERVOIR INVESTIGATIONS

Job III-a - Squawfish Control in Anderson Ranch Reservoir (R)

Job III-b - Survival and Growth of Kokanee and Coho Salmon
in Anderson Ranch Reservoir (R)

By

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JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT

State of Idaho

Name: LAKE AND RESERVOIR INVESTIGATIONS

Project No. F-53-R-6

Title: Job III-a - Squawfish Control in
Anderson Ranch Reservoir (R)

Job Nos. III-a and III-b

Job III-b - Survival and Growth
of Kokanee and Coho Salmon in
Anderson Ranch Reservoir (R)

Period Covered: March 1, 1970 to February 28, 1971

ABSTRACT

The research project at Anderson Ranch Reservoir continued in 1970. The two jobs of the project tested partial control of squawfish and evaluated introductions of kokanee and coho salmon.

We observed squawfish spawning to determine timing of fry emergence. Three rotenone treatments of the shoreline at two-week intervals killed many squawfish fry and fingerlings.

An intensive creel census conducted at Anderson Ranch Reservoir from May 17 to October 31, 1970, yielded estimates of fisherman use and harvest. During this period, anglers fished 29,613 hours to catch 32,582 fish. Boat anglers expended an estimated 24,479 hours to catch 27,871 fish consisting of 6.9 percent rainbow trout, 25.9 percent kokanee, .05 percent coho, 65.9 percent squawfish and 2.4 percent other species. Bank anglers fished an estimated 5,34 hours to catch 4,707 fish consisting of 27.2 percent rainbow trout, 8.2 percent kokanee, 0.1 percent coho, 47.5 percent squawfish and 17 percent other species.

Gill net sampling at the reservoir indicates that kokanee inhabit midwater offshore while squawfish prefer to occupy inshore and surface waters. Introduction of smallmouth bass is recommended as a predator and competitor with squawfish and to furnish a potential inshore fishery.

The progeny of the 1967 kokanee run produced approximately 50,000 mature fish in 1970.

Trends in fish populations and angler use at Anderson Ranch Reservoir began to show in comparing data collected since 1965. Squawfish, suckers and rainbow trout seem to be declining in the reservoir while kokanee and chiseimouth are increasing. Boat angler effort has increased 16 percent in the last three years while bank angler effort is off 40 percent.

Submitted by:

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RECOMMENDATIONS:

1. This project should continue in its current form until a complete evaluation of the squawfish control segment can be made.
2. Coho fingerling plants should cease. These fish provide small returns to the creel and probably compete with kokanee.
3. Kokanee fingerling plants are no longer necessary; The kokanee population can sustain itself through natural reproduction
4. Introduction of smallmouth bass (*Micropterus dolomieu*) as a population control device on squawfish and as a game fish available to bank anglers should be considered-

INTRODUCTION:

Anderson Ranch Reservoir lies on the South Fork Boise River in Elmore County, Idaho. The U. S. Bureau of Reclamation built the dam in the 1940's as one of the three large reservoirs on the Boise River system for flood control irrigation and power generation. At maximum level the reservoir stands 4,196 feet above sea level and contains 493,000 acre feet of water. Maximum depth exceeds 350 feet. The reservoir is 12 miles long with a shoreline of 44 miles. Steep rubble and sand make up most of the reservoir shoal area. Water level annually fluctuates up to 70 feet.

In 1970 the kokanee population at the reservoir boomed. Many fishermen learned how to catch kokanee and the kokanee catch was three or four times previous years' estimates. Other game fish in the reservoir include rainbow trout, coho salmon, yellow perch and Dolly Varden trout. The rainbow fishery depends almost entirely on recently planted catchable-size fish. (Ochep planted as fingerlings have provided a sporadic fishery, Dolly Varden and yellow perch are present as small, naturally reproducing populations and are usually taken incidental to rainbow and kokanee fishing. Squawfish occur in large numbers at the reservoir. They provide a nuisance to fishermen and reputedly compete with and prey upon; game fish,

The Anderson Ranch project consists of two jobs. Job III-a tested experimental partial control of squawfish through shoreline rotenone treatments of newly emergent fry. Job III-b concerns evaluation of introduced game fish.

OBJECTIVES:

To evaluate partial control of squawfish by treating newly emergent fry with rotenone in spawning areas, To evaluate the benefits of coho and kokanee salmon introductions.

TECHNIQUES USED:

Creel Census

An intensive creel census conducted at Anderson Ranch Reservoir from May 17 through October 31, 1970 yielded estimates of total angler harvest catch rates and catch composition, including both game and rough fish.

We divided the 24-week season into 12 two-week intervals. Project personnel conducted creel census on all four weekend days and two randomly selected weekdays in each two-week interval. On each creel census day we traveled the length of the reservoir one-way by boat four times, counting all boar and bank anglers. The counts started at 8 a.m., 10 a.m. 2 p.m. and 4 p.m. We employed factors derived from a similar census conducted at the reservoir in 1969 to account for fishermen fishing earlier or later than our counts.

We interviewed anglers during and between counts to determine number of hours fished and catch rates. By expanding average numbers of anglers per count and average catch rates we estimated the total effort and catch for each two-week interval. We took length measurements from kokanee and coho examined in creels.

Species Composition

We sampled the reservoir with experimental gill nets fished at 10 established shoreline stations and with vertical gill nets at four established mid-reservoir stations as-described in the 1966 annual report for F-53-R-2,

Age and Growth

We measured kokanee and squawfish taken by fishermen and gill nets and recorded the length frequencies for comparison with previous years' samples.

Squawfish Control

We treated the reservoir shoreline with rotenone three times at two week intervals starting July 13. Each treatment took two days and used 220 gallons of rotenone. We dispensed the liquid rotenone through a boat bailer at a rate of approximately five gallons per mile-

Population Trends

By comparing year-to-year catch of anglers and gill nets, we will monitor trends in the fish populations at the reservoir.

FINDINGS:

Angling Pressure

Of approximately 30,000 estimated total angler hours fished at Anderson Ranch Reservoir in 1970, 25,000 were expended by boat anglers. Fishing pressure peaked in July and tapered off rapidly in midsummer (Table 1). Excellent kokanee fishing in July and August helped maintain a high level of boat angling pressure for several weeks. At the same time, bank anglers caught few fish and pressure dropped off, Peak bank angler effort occurred around July 4 when anglers fished 819 hours in a two-week period (Table 1), Peak boat angler effort occurred the last two weeks of July with over 8,400 man-hours expended (Table 2). Considering four hours fishing as an average angler-day, of a total of approximately 7,500 angler days, about 6,250 were expended by boat anglers and 1,250 by bank anglers,

Table I: Estimates of total hours fished and catch by hank anglers at Anderson Ranch Reservoir by two-week creel census periods from May 17 - October 1R, 1970.

Period	Starting Dates	Estimated total hours fished	Estimated catch by Species					Total
			Rainbow	Kokanee	Coho	Snowfish	Others	
I	5/17	597	52	11	0	230	199	492
II	5/31	601	53	5	5	252	53	370
III	6/14	623	195	7	0	158	225	586
IV	6/28	819	238	0	0	536	138	911
V	7/12	791	248	0	0	433	45	727
VI	7/26	412	70	0	0	141	70	332
VII	8/9	311	183	0	0	128	27	338
VIII	8/23	281	12	0	0	61	0	73
IX	9/6	170	0	33	0	12	12	57
X	9/20	111	0	0	0	10	0	14
XI	10/4	318	149	328	0	170	30	686
XII	10/18	100	81	0	0	35	0	116
	Total	5134	1284	384	5	2235	799	4707
	Fish per hour		0.250	.075	<.001	.435	.156	.917
	% of catch		27.2	8.2	0.1	47.5	17.0	100.0

Table 2- Estimates of total hours fished and catch by boat anglers at Anderson Ranch Reservoir by two-week creel census periods from May 17 - October 18, 1970

Period	Starting Dates	Estimated total hours fished	Estimated catch by species					Total
			Rainbow	Kokanee	Coho	Squawfish	Others	
I	5/17	1545	275	141	59	490	7	972
II	5/31	1071	123	64	19	453	13	669
III	6/14	936	73	336	58	865	0	1332
IV	6/28	5639	750	2199	11	7421	88	10472
V	7/12	8489	314	2793	0	6655	110	9872
VI	7/26	3633	196	767	0	970	251	2187
VII	8/9	1422	5	290	0	365	10	665
VIII	8/23	715	8	89	0	162	201	460
IX	9/6	304	9	143	0	48	0	200
X	9/20	159	39	112	0	112	0	275
XI	10/4	454	77	254	0	154	0	484
XII	10/18	112	53	46	0	184	0	283
Total		24,479	1,932	7,234	147	17,879	680	27,871
Fish per hour			.079	.296	.006	.730	.028	1.142
% of catch			6.91	25.87	.05	63.95	2.43	

Angler Harvest Composition

Anglers at Anderson Ranch Reservoir harvested are estimated 32,582 fish in 1970 (Table 3). Squawfish dominate the catch - 64 percent of the boat angler catch and 48 percent of the bank angler catch. Kokanee are the most common game fish taken, making up 23 percent of all fish taken - 26 percent of the boat angler catch and 8 percent of the bank angler catch. Rainbow trout rank third in occurrence, making up 7 percent of the boat angler catch and 27 percent of the bank angler catch or 10 percent of the total (Tables 4 and 5).

The species composition of bank angler catch varied widely between two-week creel census intervals (Table 4). Rainbow trout made up from 0 to 70 percent of the catch, averaging 27 percent. Kokanee showed up sporadically but made up half the bank angler catch in two intervals during the spawning run. Squawfish contributed 100 percent of the bank angler catch in one interval but averaged only 48 percent of the season catch. Fish of other species were commonly taken early in the season but rarely taken after September.

Boat angler catch consisted predominantly of squawfish and kokanee in order of abundance (Table 5). Rainbow trout contributed significantly in spring and fall but were scarce during the warm months.

Catch Rate.

Catch rates of all species at Anderson Ranch Reservoir Lake vary seasonally with midsummer slumps and highs again in the fall (Tables 6 & 7). Squawfish catch rates peak simultaneously with peak spawning activity in July. Boat anglers enjoy high catch rates for kokanee in July and August. After August 5, three-year-old kokanee stop feeding and begin their spawning run. Two-year-old kokanee enter the catch in larger numbers in September and October. Bank anglers rarely take kokanee except as spawning fish in late summer and fall. Two factors appear to affect the increased catch rates after September: cooler weather and water bring game fish closer to the surface and inshore. Generally more expert and dedicated anglers fish in the fall because youngsters have returned to school and casual anglers have given up for the season.

Species Composition and Distribution.

Horizontal gill nets fished at established shoreline stations at Anderson Ranch in June took 95 percent rough fish (Table 8). Nets fished in a similar manner in September took 82 percent rough fish (Table 9). Mature Kokanee cruising the shoreline just prior to spawning caused the increased game fish catch in the fall sets. Squawfish, cisco, muskellunge and suckers, in order of abundance, dominate the catch. Rainbow trout, coho and immature kokanee appear in the catch in small numbers.

Vertical gill nets fished at established mid-reservoir stations spring-caught 64 percent kokanee (Table 10). Similar sets made in the fall caught 72 percent kokanee (Table 11). Kokanee, squawfish and suckers were the only species represented by more than two or three individuals in the 48 net sets. Rabies, Coho, rainbow trout and perch made up only 20 (.8) percent or 530 fish caught in the mid-reservoir sets (Tables 12-19). Seventy-eight percent of the kokanee taken in vertical gill nets in the fall occupied water deeper than 40 feet (Table 11). Only 22 percent of the squawfish taken occupied water deeper than 40 feet (Table 10). In vertical nets in the spring 48 percent of kokanee and 22 percent of squawfish occupied water deeper than 20 feet (Table 10). Apparently kokanee prefer greater depths than do squawfish. Even when

Table 3. Estimates of total hours fished by all anglers at Anderson Ranch Reservoir by two-week creel census intervals, May 17 - October 30, 1970

Period	Starting Date	Estimated Total Hours	Rainbow	Kokanee	Coho	Squawfish	Others	Total
I	5/17	2,142	327	152	59	720	206	1,464
II	5/31	1,672	176	69	24	705	66	1,039
III	6/14	1,559	248	343	58	1,023	225	1,918
IV	6/28	6,458	988	2,199	11	7,957	226	11,383
V	7/12	9,280	562	2,793	00	7,089	155	10,598
VI	7/26	4,045	266	767	00	1,161	321	2,519
VII	8/9	1,733	188	290	00	493	37	1,008
VIII	8/23	996	20	89	00	223	201	533
IX	9/6	474	9	176	00	60	12	257
X	9/20	270	39	112	00	131	00	294
XI	10/4	772	226	582	00	333	30	1,170
XII	10/18	212	134	46	00	219	00	399
TOTAL		29,613	3,193	7,618	152	20,114	1,479	32,582
Fish per Hour			.108	.257	.005	.679	.050	1.100
% of Catch			9.8	23.4	0.5	61.7	4.5	100

Table 4, Percentage composition of the catch of bank anglers at Anderson Ranch
Reservoir by two-week creel census periods, May 17 - October 18, 1970

Period	Starting Dates	Percent of Catch within the Period					Total
		Rainbow	Kokanee	Coho	Squawfish	Others	
I	5/17	10.6	2.1	0	46.8	40.5	100
II	5/31	14.5	1.4	1.4	68.1	14.6	100
III	6/14	33.3	1.3	0	26.9	38.5	100
IV	6/28	26.0	0	0	58.8	15.2	100
V	7/12	34.1	0	0	59.5	6.4	100
VI	7/26	21.2	0	0	57.6	21.2	100
VII	8/9	54.1	0	0	37.8	8.1	100
VIII	8/23	16.7	0	0	83.3	0	100
IX	9/6	0	55.5	0	22.2	22.3	100
X	9/20	0	0	0	100.0	0	100
XI	10/4	21.7	47.8	0	26.1	4.4	100
XII	10/18	70.0	0	0	30.0	0	100
All periods combined average		27.2	8.2	<0.1	47.5	17.0	100

Table 5. Percentage composition of boat angler catch at Anderson Ranch
Reservoir by two-week creel census periods, May 17 - October 18,
1970

Period	Starting Date	Percent of Catch in the Period					Total
		Rainbow	Kokanee	Coho	Squawfish	Others	
I	5/17	28.2	14.5	6.1	50.4	0.8	100
II	5/31	18.4	9.7	2.9	67.6	1.4	100
III	6/14	6.0	23.9	4.1	61.5	4.5	100
IV	6/28	7.2	21.0	0.1	70.9	0.8	100
V	7/12	3.2	28.3	0.0	67.4	1.1	100
VI	7/26	9.0	35.1	0.0	44.4	11.5	100
VII	8/9	0.5	43.5	0.0	54.9	1.1	100
VIII	8/23	1.7	19.3	0.0	35.3	43.7	100
IX	9/6	4.3	71.7	0.0	23.9	0.1	100
X	9/20	14.1	40.8	0.0	45.1	0.0	100
XI	10/4	15.9	52.4	0.0	31.7	0.0	100
XII	10/18	18.6	16.3	0.0	65.1	0.0	100
All periods combined average		6.9	25.9	0.1	64.0	3.1	100

Table 6. Catch rates (fish per hour) of boat anglers at Anderson Ranch Reservoir by two-week creel census periods, May 17-October 31, 1970.

Period	Starting Date	Rainbow	Kokanee	Coho	Squawfish	Others	Total
I	5/17	.18	.09	.04	.32	<.01	.63
II	5/31	.12	.06	.02	.42	.01	.63
III	6/14	.08	.36	.06	.92	0	1.50
IV	6/28	.13	.39	<.01	1.32	.02	1.86
V	7/12	.04	.33	0	.78	.01	1.16
VI	7/26	.05	.21	0	.27	.07	.60
VII	8/9	<.01	.12	0	.23	.28	.64
VIII	8/23	<.01	.12	0	.26	.01	.47
IX	9/6	.03	.47	0	.16	0	.66
X	9/20	.24	.71	0	.78	0	1.73
XI	10/4	.17	.56	0	.34	0	1.06
XII	10/18	.47	.41	0	1.65	0	2.53
All periods combined averages		.08	.30	.01	.73	.03	1.14

Table 7. Catch Rates (fish per hour) of bank anglers at Anderson Ranch Reservoir by two-week creel census periods, May 17-October 31, 1970.

Period	Starting Date	Rainbow	Kokanee	Coho	Squawfish	Others	Total
I	5/17	.09	.02	0	.39	.33	.82
	5/31	.09	.01	.01	.42	.09	.62
	6/14	.31	.01	0	.25	.36	.94
IV	6/28	.29	0	0	.65	.17	1.11
V	7/12	.31	0	0	.55	.06	.92
VI	7/26	.17	0	0	.46	.17	.81
VII	8/9	.59	0	0	.41	.09	1.09
VIII	8/23	.04	0	0	.22	0	.26
IX	9/6	0	.19	0	.08	.08	.35
X	9/20	0	0	0	.17	0	.17
XI	10/4	.47	1.03	0	.56	.09	2.16
XII	10/18	.81	0	0	.35	0	1.15
All periods combined average		.25	.08	<.01	.44	.16	.92

Table 8. Species composition of the catch of experimental gill nets fished at 10 sampling stations, Anderson Ranch Reservoir, June 1-3, 1970 (20 hours per set, 200 total hours).

Location	Date Set	Species Captured							TOTAL
		SQ	CMC	CSS	RBT	KOK	COHO	OTHERS	
Badger Creek Bay	June 1, 1970	62	4	14	2	4	8	0	94
Perch Point	"	93	16	12	1	2	0	0	124
Lime Creek Bay	"	74	25	28	2	6	2	1	138
Lester Creek Bay	"	66	11	7	4	2	3	2	95
Wood Creek Bay	June 2, 1970	102	10	2	1	1	0	0	116
Powerline Point	"	80	22	19	3	1	0	0	125
Castle Creek Bay	"	43	23	16	1	1	0	1	84
Wilson Creek Bay	"	84	32	4	2	2	0	1	124
Camas Creek Bay	June 3, 1970	38	3	3	1	0	1	1	46
Dam Forebay	"	106	20	0	3	4	5	1	138
Total		748	166	105	20	23	19	7	1088
Percent of total		68.7	15.2	9.6	1.8	2.1	1.7	0.6	100
Fish per hour		3.74	.83	0.53	0.10	0.12	0.09	.03	5.44

SQ - Squawfish

CMC - Chiselmouth

CSS - Coarsescale sucker

RBT - Rainbow trout

KOK - Kokanee salmon

COHO - Coho salmon

Others includes yellow perch, mountain whitefish and redbreast shiners

Table 9. Species composition of catch of experimental gill nets fished at 10 sampling stations, Anderson Ranch Reservoir, September 17-19, 1970 (20 hours per set, 200 total hours).

Location	Date Set	Species captured							TOTAL
		SQ	CMC	CSS	RBT	KOK	COHO	YP	
Badger Creek Bay	September 17	26	20	1	1	40	1	2	91
Perch Point	"	53	8	2	1	11	0	5	80
Lime Creek Bay	"	41	9	16	4	6	0	0	76
Lester Creek Bay	September 18	39	8	1	0	9	1	0	58
Wood Creek Bay	"	55	12	2	0	1	0	0	70
Powerline Point	"	67	2	0	0	10	0	0	79
Castle Creek Bay	September 19	12	9	0	1	12	2	0	36
Wilson Creek Bay	"	54	25	2	3	25	1	0	110
Camas Creek Bay	"	52	12	0	4	3	0	0	71
Dam Forebay	"	61	17	1	6	7	0	0	92
Total		460	122	25	20	124	5	7	763
Percent of total		60.3	16.0	3.3	2.6	16.3	0.7	0.9	100
Fish per hour		2.30	.61	.13	.10	.62	.03	.04	3.82

SQ - Squawfish
 CMC - Chiselmouth
 CSS - Coarsescale sucker
 RBT - Rainbow trout
 KOK - Kokanee salmon
 COHO - Coho salmon
 YP - Yellow perch

Table 10. Species composition, vertical temperature-profile and depth distribution of fish caught in 24 vertical gill net sets, Anderson Ranch Reservoir, May 25, 26, 27, and 28, 1970

Temperature data		Vertical Distribution (ft.)	Species captured			
Depth (ft.)	Temperature (°F.)		Kokanee	Squawfish	Suckers	Others
0	55 - 60	0-10	28	35	12	2
10	52 - 58	10-20	79	22	4	1
20	50 - 52	20-30	44	5	2	0
30	48 - 50	30-40	21	2	2	0
40	47 - 49	40-50	13	1	3	2
50	47 - 49	50-60	4	2	2	0
60	46 - 48	60-70	4	1	0	0
70	45 - 48	70-80	6	3	3	1
80	45 - 47	80-90	4	2	5	0
90	45 - 47	90-100	4	0	5	0
100	44 - 47	Total	207	73	38	6
		Percent of Total	63.4	22.5	11.7	1.9

Table Species composition, vertical temperature profile and depth distribution of fish caught in 24 vertical gill net sets, Anderson Ranch Reservoir, September 20, 21, 26, 27, 1970.

Temperature data		Vertical Distribution (ft.)	Species captured			
Depth (ft.)	Temperature (°F.)		Kokanee	Squawfish	Suckers	Others
0	61 - 62	0-10	5	12	0	3
10	61	10-20	6	6	0	1
20	61	20-30	13	7	0	0
30	61	30-40	13	5	0	3
40	60 - 61	40-50	18	1	0	2
50	58 - 60	50-60	23	1	0	4
60	54 - 58	60-70	16	0	2	1
70	52 - 54	70-80	30	3	2	0
80	51	80-90	28	3	2	0
90	50	90-100	16	5	3	0
100	49 - 50	Total	168	43	9	14
		Percent of Total	71.8	18.4	3.8	6.0

Table 12 Species composition, vertical temperature profile, and depth distribution of fish captured in six vertical gill net sets in mid-reservoir off Perch Point, Anderson Ranch Reservoir, May 25, 1970.

Temperature data		Vertical Distribution (ft.)	Species Captured			
Depth (feet)	Temperature (°F.)		Kokanee	Squawfish	Suckers	Others
0	55	0-10	12	7	7	0
10	52	10-20	27	9	3	0
20	50	20-30	19	1	1	0
30	49	30-40	6	1	2	0
40	49	40-50	5	1	1	1
50	49	50-60	2	1	1	0
60	48	60-70	2	0	0	0
70	48	70-80	0	2	3	0
80	47	80-90	2	2	4	0
90	47	90-100	1	0	5	0
100	47		<u>76</u>	<u>24</u>	<u>27</u>	<u>1</u>

Table 13 Species composition, vertical temperature profile and depth distribution of fish captured in six vertical gill net sets in mid-reservoir off Lester Creek, Anderson Ranch Reservoir, May 26, 1970.

Temperature Data		Vertical Distribution (ft.)	Species Captured			
Depth (ft.)	Temperature (°F.)		Kokanee	Squawfish	Suckers	Others
0	60	0-10	3	13	0	0
10	56	10-20	16	11	0	0
20	52	20-30	9	3	1	0
30	48	30-40	5	0	0	0
40	47	40-50	2	0	2	0
50	47	50-60	0	0	1	0
60	47	60-70	1	0	0	0
70	46	70-80	2	1	0	0
80	46	80-90	1	0	1	0
90	45	90-100	3	0	0	0
100	45		<u>51</u>	<u>25</u>	<u>5</u>	<u>0</u>

Table I4 Species composition, vertical temperature profile and depth distribution of fish caught in **six** vertical gill net sets in mid-reservoir off Fall Creek, Anderson Ranch Reservoir, **May 27, 1970,**

Temperature Data		Vertical Distribution (ft.)	Species captured			
Depth (ft.)	Temperature (°F.)		Kokanee	Squawfish	Suckers	Others
0	59	0-10	5	10	3	0
10	58	10-20	23	1	1	1
20	51	20-30	8	0	0	0
30	50	30-40	3	0	0	0
40	49	40-50	4	0	0	0
50	48	50-60	2	0	0	0
60	48	60-70	0	0	0	0
70	47	70-80	4	0	0	0
80	47	80-90	0	0	0	0
90	46	90-100	0	0	0	0
100	46		<u>49</u>	<u>11</u>	<u>4</u>	<u>1</u>

Table 15 Species composition, vertical temperature profile and depth distribution of fish caught in **six** vertical gill net sets in mid reservoir, Dan Frebay, Anderson Ranch Reservoir, **May 28, 1970.**

Temperature Data		Vertical Distribution (ft.)	Species captured			
Depth (ft.)	Temperature (°F.)		Kokanee	Squawfish	Suckers	Others
0	58	0-10	8	5	2	2
10	55	10-20	13	1	0	0
20	50	20-30	8	1	0	0
30	48	30-40	7	1	0	0
40	47	40-50	2	0	0	1
50	47	50-60	0	1	0	0
60	46	60-70	1	0	0	0
70	45	70-80	0	0	0	1
80	45	80-90	1	0	0	0
90	45	90-100	0	0	0	0
100	44		<u>42</u>	<u>9</u>	<u>2</u>	<u>4</u>

Table 16 Species composition, vertical temperature profile and depth di^stribution of fish caught in **six** vertical gill net sets in mid-reservoir off Fall Creek, Anderson Ranch Reservoir, September 20, 1970.

Temperature data		Vertical Distribution (ft.)	Species Captured			
Depth (ft.)	Temperature (°F.)		Kokanee	Squawfish	Suckers	Others
0	61	0-10	2	4	0	1
10	61	10-20	1	0	0	1
20	61	20-30	2	2	0	
30	61	30-40	1	2	0	0
40	61	40-50	4	0	0	0
50	58	50-60	10	0	0	1
60	54	60-70	12	0	0	1
70	52	70-80	11	0	0	0
80	51	80-90	16	0	0	0
90	50	90-100	7	0	0	0
100	49		<u>66</u>	<u>8</u>	<u>0</u>	<u>4</u>

Table 17 Species Composition, vertical temperature profile and depth distribution of fish caught in six vertical gill net sets in mid-reservoir, Dan Forebay, Anderson Ranch Reservoir, September 27, 1970.

Temperature		Vertical Distribution (ft.)	Species captured			
Depth (ft.)	Temperature (°F.)		kokanee	Squawfish	Suckers	Others
0	61	0-10	1	4	0	2
10	61	10-20	1	0	0	0
20	61	20-30	2	1	0	0
30	61	30-40	3	1	0	1
40	60	40-50	2	0	0	2
50	58	50-60	2	1	0	2
60	54	60-70	7	0	0	1
70	52	70-80	2	1	0	0
80	51	80-90	0	0	0	0
90	50	90-100	5	1	0	0
100	50		<u>25</u>	<u>9</u>	<u>0</u>	<u>8</u>

Table 18 Species composition, vertical temperature profile, and depth distribution of fish caught in six gill net sets in mid-reservoir off Perch Point, Anderson Ranch Reservoir, September 21, 1970.

Temperature Data		Vertical Distribution (ft.)	Species captured			
Depth (ft.)	Temperature (°F.)		Kokanee	Squawfish	Suckers	Others
0	61	0-10	1	0	0	0
10	61	10-20	1	5	0	0
20	61	20-30	5	3	0	0
30	61	30-40	3	0	0	1
40	61	40-50	5	1	0	0
50	59	50-60	2	0	0	0
60	57	60-70	8	0	2	0
70	53	70-80	6	1	1	0
80	51	80-90	2	2	2	0
90	50	90-100	2	3	2	0
100	50		35	15	7	1

Table 19 Species composition, vertical temperature profile and depth distribution of fish caught in six vertical gill net sets in mid-reservoir off Lester Creek, Anderson Ranch Reservoir, September 26, 1970.

Temperature data		Vertical Distribution (ft.)	Species Captured			
Depth (ft.)	Temperature (°F.)		Kokanee	Squawfish	Suckers	Others
0	62	0-10	1	4	0	0
10	61	10-20	3	1	0	0
20	61	20-30	4	1	0	0
30	61	30-40	6	2	0	1
40	61	40-50	7	0	0	0
50	60	50-60	9	0	0	1
60	58	60-70	3	0	0	0
70	54	70-80	6	1	1	0
80	51	80-90	10	1	0	0
90	50	90-100	2	1	1	0
100	50		51	11	2	2

kokanee are in the surface waters they are not found inshore. Although kokanee made up 37 percent of the catch in the upper 40 feet of the spring vertical gill net sets, they only made up 2 percent of the catch in experimental nets fished along the shoreline at the same time. Squawfish made up 69 percent of the experimental gill net catch and 45 percent of the catch in the upper 40 feet of the vertical nets.

Squawfish and kokanee are our major concern at Anderson Ranch Reservoir. Squawfish currently dominate the fish population of the reservoir in numbers but kokanee are on the increase. Knowledge of interactions between the two species is vital to managing the Anderson Ranch fishery. Squawfish have the reputation of being serious predators and competitors for food and space with kokanee. Vertical and horizontal gill net sets indicate the two species have different habitat preferences. Squawfish occupy shoreline and surface waters; kokanee are more generally found offshore in midwater. This difference is more marked when the reservoir is thermally stratified but apparently occurs year around.

This differential habitat preference serves to minimize interactions between kokanee and squawfish during much of the year. Squawfish occupy a niche at Anderson Ranch that is unsuited for salmonids. If we wish to replace squawfish biomass with game fish biomass, we need to introduce a game species which will occupy surface and inshore waters. Hence, the recommendation for introduction of smallmouth bass. Smallmouth in other Idaho waters occupy a temperature regime similar to that occupied by squawfish at Anderson Ranch. Smallmouth usually occupy inshore and surface water and favor steep rocky shorelines like those at Anderson Ranch. Smallmouth become inactive at 60° F which is the upper limit of kokanee preference. Benefits accruing from smallmouth bass introductions include: 1. A game fish available to bank anglers; 2. Competition with rough fish in water currently not occupied by game fish; 3. A self-sustaining fishery complimentary to the self-sustaining kokanee fishery.

Kokanee and Coho Survival and Growth

We estimated that anglers caught only 152 coho at Anderson Ranch in 1970. Low survival of planted coho fingerlings or emigration of "smolt" coho in the spill water probably explain the small return to the creek. The only year there has been a good return of coho fingerling plants was 1968 when slightly over 1 percent (3,600) of the 1967 fingerling plant showed in the creek (F-53-R-4). The reservoir did not fill in 1968; consequently, there was no opportunity for coho to leave the reservoir except through the powerhouse turbines which have intake openings 200 feet below the surface. In 1969 and 1970, the reservoir did fill and spill for some time and few coho were recorded in the catch (Table 20). Sportsmen reported observing coho going over the spillway and catching many coho below the spillway.

The estimated catch plus spawning run of kokanee in 1970 totaled 30 to 50 thousand fish, two fish, two to three times greater than the previous three years' estimates of 12 to 15 thousand. This run included progeny of the 1967 spawning run plus survivors of 125,000 fingerlings planted in 1968.

Length frequency samples of fish in the creek and gill nets indicate that three-year-old kokanee grow about 60 mm, from 330 mm to 390 mm, in the three summer months before they spawn. Immature kokanee (two-year-olds) grow 80 to 100 mm from 150 mm to 230-250 mm in the same period (Figure 11).

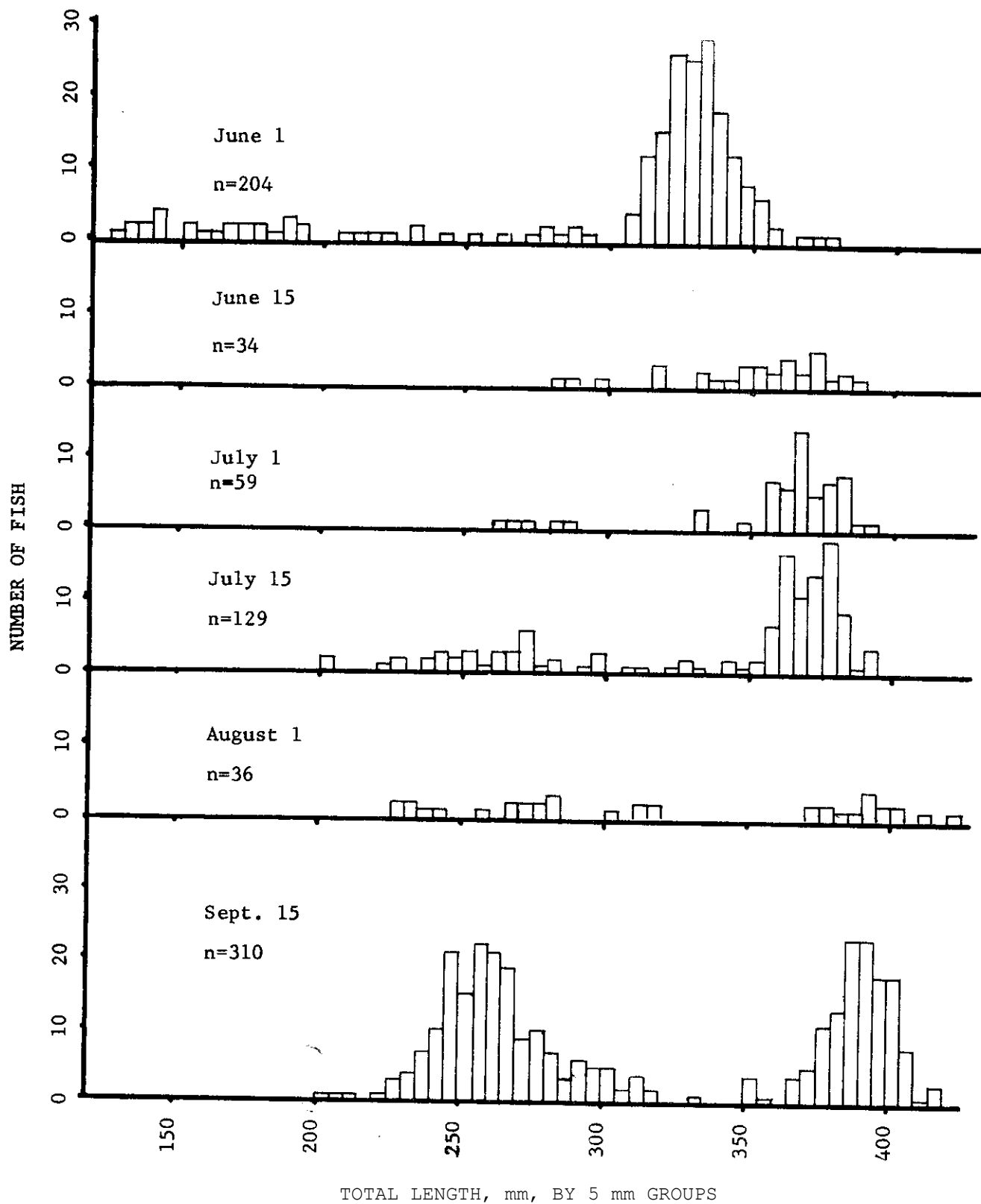


Figure 1. Length frequencies of kokanee sampled in creel and gill nets during 1970 at Anderson Ranch Reservoir.

Squawfish Growth

Length frequency plots of squawfish taken in gill nets in June and September indicate that immature (three-year-old) squawfish increase in total length from 220 mm to 265 mm during the summer months. Mature female squawfish measured 275 to 605 mm total length with a modal length of 320 mm. Mature male squawfish measured 215 to 345 mm with a modal length of 310 mm (Figure 24). During the summer months no change showed in the average length of mature (four- and five-year-old) squawfish sampled. The modes of length frequency distributions of mature squawfish sampled in June and September fell in the 310 to 320 mm size groups.

Squawfish Control

Project personnel treated the reservoir shoreline with rotenone to kill squawfish fry as in past years. We repeated the treatment three times at two-week intervals starting July 13. Each treatment took two days. We used about 220 gallons of rotenone per treatment instead of 400 used previously and still achieved a thorough kill of squawfish fry and fingerlings.

During the first treatment we observed large schools of 1969 year-class squawfish fingerlings. Many of these fingerlings succumbed to the first treatment. After the first treatment we saw very few 1969 year-class fish. Some fry survived each of the treatments, but fingerlings seem to be very vulnerable and we will kill many 1970 survivors in 1971. After we had completed all treatments in 1970, fish from the 1968 year classes were scarce. Only 8 percent of the squawfish in the fall 1970 experimental gill net sets were 1968 year-class fish compared to 15 percent 1967 year-class squawfish in 1969 fall experimental gill net sets.

Kokanee Runs

Progeny of the first 1967 kokanee spawning run into the South Fork Boise River and tributaries produced the largest runs of kokanee we have seen at the reservoir. We estimated about 10,000 kokanee in the river, 10,000 in Trinity Creek, about 6,000 in Fall Creek and 1,000 in Castle Creek. A few kokanee ran Lame Creek and some were observed near the mouths of other small reservoir tributaries. Many kokanee apparently attempt to spawn on the reservoir shoreline or do not spawn at all. Gill nets fished during the spawning run took ripe fish from tributaries. Anglers were still taking mature kokanee in mid-reservoir as late as October 15, two months after the first spawners had entered the river.

Population Trends

We have fished gill nets at the same stations at the same time of year annually since 1965. Vertical gill net catches reflect the ascendancy of kokanee (Table 21). Kokanee increased from less than one percent of the 1965 catch to over 70 percent of the 1970 catch. Squawfish simultaneously declined from 54 to 18 percent of the vertical net catch. Suckers and yellow perch also appear to be declining. Coho had a strong showing in 1968. The proportionally greater contribution of kokanee exaggerates the proportionally smaller contribution of the other species. However, catch per hour of the vertical gill nets reflects similar trends (Table 22).

Horizontal experimental gill net catches show little change in the proportion or catch per hour of squawfish (Tables 23 & 24). Kokanee spawning runs add significantly to the fall game fish catches since 1968. Chisalmoun increased from 5 to 16

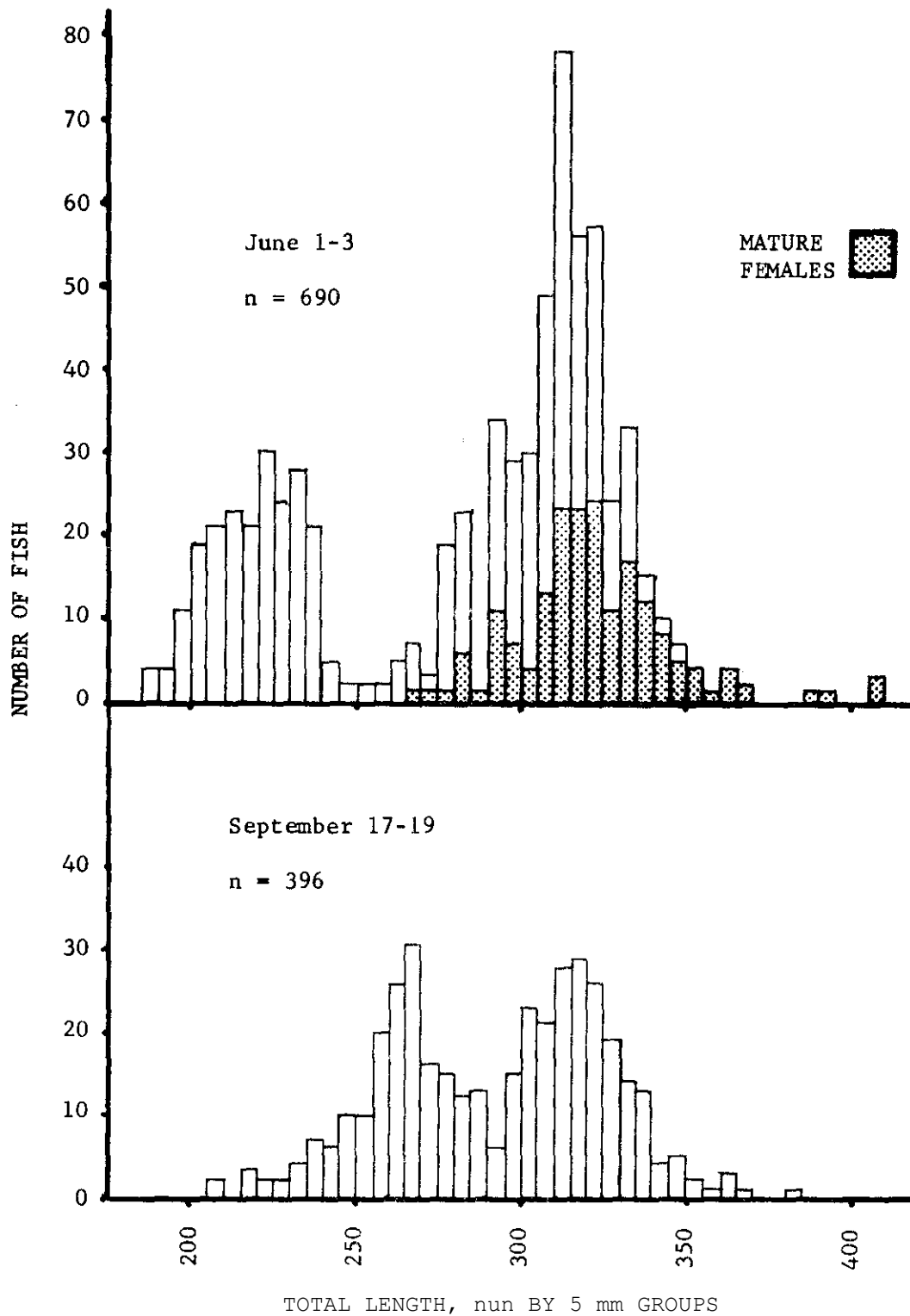


Figure 2. Length frequencies of squawfish taken in gill nets in June and September, 1970. Each sample represents the catch of ten gill net sets of 20 hours each at the same sites.

Table 20. Hatchery Plants and Game Fish Catch Estimates 1965 - 1970, Anderson Ranch Reservoir

Year	Number Planted			Number Caught		
	Kokanee	Coho	Rainbow*	Kokanee	Coho	Rainbow
1965	1,120,720	-	113,000	- -	-	- -
1966	390,000	-	10,200**	- -	-	- -
1967	208,000	342,383	36,700	- -	-	- -
1968	124,740	351,330	35,862	2,518	3,640	6,067
1969	122,000	357,200	12,726	1,956	857	5,982
1970	200,000	350,000	12,000	7,618	152	3,193

Catchable Size

** Plus 100,000 fingerling

Table 21, Percentage species composition the catch of vertical gill nets set at four standard mid-reservoir stations in August and September at Anderson Ranch Reservoir, 1965-1970.

Year	Species						
	KOK	SQ	CSS	YP	RBT	COHO	OTHERS
1965	1	54	19	23	-	-	28
1966	7	47	29	9	6	-	<1
1967	53	37	3	<1	3	3	<1
1968	34.5	31.4	18.4	1.5	<1	11.8	2.1
1969	60.3	26.4	8.0	<1	<1	4.1	<1
1970	72.8	18.1	3.7	0	2.9	1.2	<1

Table 22, Catch per hour of fish taken in vertical gill nets fished at four mid-reservoir stations at Anderson Ranch Reservoir, August and September, 1965-1970.

Year	Species caught: fish per hour			
	Squawfish	Sucker	Kokanee	Other
1965	0.14	0.05	0.00	0.06
1966	0.17	0.11	0.03	0.05
1967	0.13	0.01	0.19	0.02
1968	0.24	0.17	0.26	0.13
1969	0.12	0.04	0.29	0.02
1970	0.09	0.02	0.37	0.00

Table 23. Percent species composition of the catch of experimental gill nets set at ten standard shoreline stations in August and September at Anderson Ranch Reservoir, 1965-1970.

YEAR	SPECIES							
	SQ	CMC	CSS	KOK	COHO	BRT	YP	OTHERS
1965	52	5	23	0	0	2	13	5
1966	66.3	4.7	19.0	0	0	3.8	4.8	1.4
1967	90	3	3	0	0	1	3	
1968	38.4	4.4	8.1	19.4*	0	1.5	<1	<1
1969	71.2	7.2	6.1	7.0*	<1	2.1	5.8	<1
1970	60.3	16.2	3.3	16.3*	0.7	2.6	0.9	<1

* SPAWNERS

Table ²⁴. Catch per hour of fish in experimental gill nets set at 10 stations at Anderson Ranch Reservoir 1965-1970.

Time of Netting	Species caught : fish per hour					
	Squawfish	Sucker	Chiselmouth	Rainbow	Kokanee	Other
1965 (August)	0.60	0.24	0.05	0.02	0.00	0.16
1966 (August)	3.40	1.00	0.15	0.20	0.00	0.10
1967 (August)	1.80	<0.10	<0.10	<0.10	0.00	0.10
1968 (August)	1.34	0.28	0.15	<0.10	0.681/	0.00
1969 (September)	2.93	0.25	0.30	<0.10	0.291/	0.24
1970 (September)	2.30	0.13	0.61	0.10	0.621/	0.04

1 Kokanee Spawners

percent of the catch while suckers decreased from 23 to 3 percent (Table 23). Rainbow trout, yellow perch, and "others" (shiners, whitefish, Dolly Varden) appear less abundant now than five years ago.

Project personnel have conducted creel census at Anderson Ranch Reservoir during the peak fishing period since 1968. Boat angler effort increased 16 percent over the three years of the census while bank angler effort decreased 40 percent (Table 25). Total effort changed insignificantly from 29,638 hours estimated in 1968 to 29,615 hours in 1970. Rainbow trout catch declined by half while kokanee catch tripled (Table 20). Total catch of rainbow trout reflects reduced plants in 1969 and 1970 while kokanee catch reflects the population trend. Coho catch was high only in 1968 in spite of similar numbers planted in 1967, 1968, 1969 and 1970 for reasons explained above. Squawfish catches are down 15 percent for boat anglers and 70 percent for bank anglers (Table 25). Squawfish catch rates are down 18 percent for boat anglers and 44 percent for bank anglers (Table 26). Percentage of squawfish in catch decreased from 69 to 64 percent for boat anglers and from 67 to 47 percent for bank anglers (Table 27).

Table 25. Estimates of total effort and catch of anglers at Anderson Ranch Reservoir, 1968-1970,

BOAT ANGLERS							
Year	Total Hours	RBT	KOK	COHO	SQ	OTHERS	TOTAL
1968	21,115	3,944	2,420	2,623	20,207	61*	29,255
1969	18,940	3,391	1,946	770	16,618	384	23,111
1970	24,479	1,932	7,234	147	17,618	680	27,955

BANK ANGLERS							
Year	Total Hours	RBT	KOK	COHO	SQ	OTHERS	TOTAL
1968	8,523	2,123	98	1,017	6,995	185*	10,418
1969	8,106	2,480	10	87	5,103	1,506	9,186
1970	5,134	1,284	384	5	2,235	799	4,707

* 1968 "Others" includes only Dolly Varden and Yellow Perch, 1969 and 1970 includes all species.

Table 26. Catch rates of all anglers at Anderson Ranch Reservoir, 1968-1970.

BOAT ANGLERS						
YEAR	Fish per Hour				OTHERS	TOTAL
	RBT	KOK	COHO	SQ		
1968	.18	.12	.15	.88	.02*	1.33
1969	.179	.103	.041	.877	.020	1.220
1970	.079	.296	.006	.730	.028	1.142

BANK ANGLERS						
YEAR	Fish per Hour				OTHERS	TOTAL
	RBT	KOK	COHO	SQ		
1968	.28	.01	.13	.76	.02*	1.20
1969	.311	.001	.010	.612	.181	1.116
1970	.250	.075	.001	.435	.156	.917

* 1968 "Others" includes only Dolly Varden and Yellow Perch. 1969 and 1970 includes all species,

Table 27. Percent catch composition of angler catch, Anderson Ranch Reservoir, 1968-1970.

BOAT ANGLERS							
YEAR	TOTAL FISH	PERCENT OF CATCH					TOTAL
		RBT	KOK	COHO	SQ	OTHERS	
1968	29,255	13.5	8.3	9.0	69.0	0.2*	100.0
1969	23,111	14.7	8.4	3.3	71.9	1.7	100.0
1970	27,955	6.9	25.9	0.1	64.0	2.4	100.0

BANK ANGLERS							
YEAR	TOTAL FISH	PERCENT OF CATCH					TOTAL
		RBT	KOK	COHO	SQ	OTHERS	
1968	10,418	20.4	0.9	9.8	67.1	1.8*	100.0
1969	9,186	27.0	0.1	0.9	55.6	16.4	100.0
1970	4,707	27.2	8.2	0.1	47.5	17.0	100.0

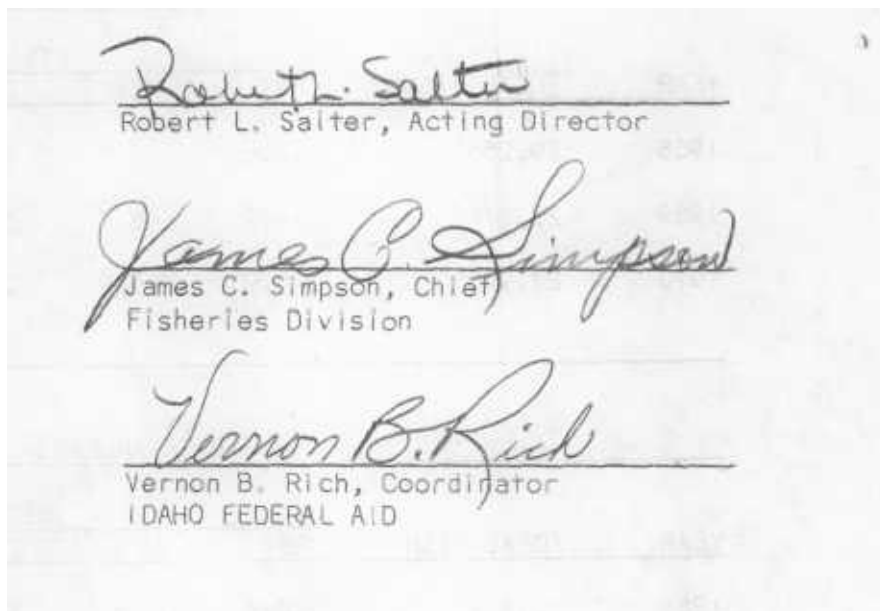
* 1968 "others" includes only Doily Varden and Yellow Perch . 1969 and 1970 includes all species.

Submitted by:

Herbert A Pollard II Fishery
Research Biologist

Approved by:

IDAHO FISH AND GAME DEPARTMENT



The image shows three handwritten signatures, each followed by a horizontal line and then the printed name and title of the signatory. The first signature is 'Robert L. Salter', followed by 'Robert L. Salter, Acting Director'. The second signature is 'James C. Simpson', followed by 'James C. Simpson, Chief Fisheries Division'. The third signature is 'Vernon B. Rich', followed by 'Vernon B. Rich, Coordinator IDAHO FEDERAL AID'.

Robert L. Salter
Robert L. Salter, Acting Director

James C. Simpson
James C. Simpson, Chief
Fisheries Division

Vernon B. Rich
Vernon B. Rich, Coordinator
IDAHO FEDERAL AID